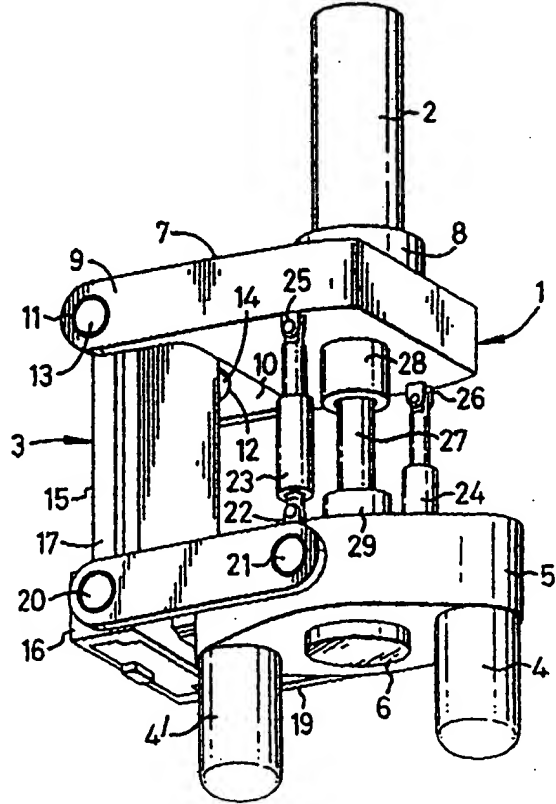


PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : E21B 19/16	A1	(11) International Publication Number: WO 00/11310 (43) International Publication Date: 2 March 2000 (02.03.00)
<p>(21) International Application Number: PCT/GB99/02708</p> <p>(22) International Filing Date: 16 August 1999 (16.08.99)</p> <p>(30) Priority Data: 9818360.1 24 August 1998 (24.08.98) GB</p> <p>(71) Applicant (for all designated States except US): WEATHER-FORD/LAMB, INC. [US/US]; c/o CSC - The United States Corporation Company, 1013 Centre Road, Wilmington, DE 19805 (US).</p> <p>(71) Applicant (for GB only): HARDING, Richard, Patrick [GB/GB]; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB).</p> <p>(72) Inventor; and (75) Inventor/Applicant (for US only): PIETRAS, Bernd-Goerg [DE/DE]; Sandriedeweg 12, D-30900 Wedemark (DE).</p> <p>(74) Agent: LIND, Robert; Marks & Clerk, 4220 Nash Court, Oxford Business Park South, Oxford OX4 2RU (GB).</p>		<p>(81) Designated States: AU, CA, GB, NO, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).</p> <p>Published With international search report.</p>
<p>(54) Title: AN APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE</p> <p>(57) Abstract</p> <p>An apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising a motor (4, 4') for rotating a tool (30) for drivingly engaging a tubular, and means (3) for connecting said motor (4, 4') to said top drive, the apparatus being such that, in use, said motor (4, 4') can rotate one tubular with respect to another to connect said tubular.</p> 		

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LJ	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

AN APPARATUS FOR CONNECTING TUBULARS USING A TOP DRIVE

This invention relates to an apparatus for facilitating the connection of tubulars using a top drive and is more particularly, but not exclusively, intended for facilitating the connection of a section or stand of casing to a string of casing.

In the construction of oil or gas wells it is usually necessary to line the borehole with a string of tubulars known as a casing. Because of the length of the casing required, sections or stands of say two sections of casing are progressively added to the string as it is lowered into the well from a drilling platform. In particular, when it is desired to add a section or stand of casing the string is usually restrained from falling into the well by applying the slips of a spider located in the floor of the drilling platform. The new section or stand of casing is then moved from a rack to the well centre above the spider. The threaded pin of the section or stand of casing to be connected is then located over the threaded box of the casing in the well and the connection is made up by rotation there between. An elevator is then connected to the top of the new section or stand and the whole casing string lifted slightly to enable the slips of the spider to be released. The whole casing string is then lowered until the top of the section is adjacent the spider whereupon the slips of the spider are re-applied, the elevator disconnected and the process repeated.

It is common practice to use a power tong to torque the connection up to a predetermined torque in order to make the connection. The power tong is located on a platform, either on rails, or hung from a derrick on a chain. However, it has recently been proposed to use a top drive for making such connection. The normal use of such a top drive may be the driving of a drill string.

A problem associated with using a top drive for rotating tubulars in order to obtain a connection between tubulars is that some top drives are not specifically designed for rotating tubulars are not able to rotate at the correct speed or have non standard rotors.

5 According to the present invention there is provided an apparatus for facilitating the connection of tubulars using a top drive, said apparatus comprising a motor for rotating a tool for drivingly engaging a tubular, and means for connecting said motor to said top drive, the apparatus being such that, in use, said motor can rotate one tubular with respect to another to connect said tubulars.

10 Other features of the invention are set out in Claims 2 et seq.

For a better understanding of the present invention and in order to show how the same may be carried into effect reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a front perspective view of an apparatus in accordance with the
15 present invention; and

Figure 2 is a rear perspective view of the apparatus of Figure 1 in use.

Referring to Figure 1 there is shown an apparatus which is generally identified by reference numeral 1.

The apparatus 1 comprises a connecting tubular 2, a suspension unit 3 and a
20 hydraulic motor 4 and 4'. The hydraulic motor 4,4' has a stator 5 and a rotor 6 and is driven by a supply of pressurised hydraulic fluid (the fluid supply lines are not illustrated in the Figures). The suspension unit 3 suspends the hydraulic motor 4,4' from the connecting tubular 2.

The suspension unit 3 comprises a plate 7 which is fixed to the connecting tubular 2 by a collar 8. The plate 7 has two projections 9 and 10 which have holes 11 and 12 for accommodating axles 13 and 14, which are rotationally disposed therein. The axles 13 and 14 are integral with a rigid body 15. A slider 16 is arranged on runners 17 and (not shown) on the rigid body 15. Arms 18 and 19 are connected at one end to the slider 16 via spherical bearings 20 and at the other end to each side of the stator 5 via spherical bearings 21 and 21'. The arms 18 and 19 are provided with lugs 22 and 22' to which one end of a piston and cylinder 23, 24 is attached and are movable thereabout. The other end of each piston and cylinder 23, 24 is attached to lugs 25, 26 respectively and is movable thereabout. A mud pipe 27 is provided between the plate 7 and the stator 5 for carrying mud to the inside of a tubular therebelow. The mud pipe 27 comprises curved outer surfaces at both ends (not shown) which are located in corresponding recesses in cylindrical sections 28, 29, thus allowing a ball and socket type movement between the plate 7 and the stator 5.

Referring to Figure 2, the apparatus 1 is suspended from a top drive (not shown) via connecting shaft 2. A tool 30 for engaging with a tubular is suspended from beneath the rotor 6 of the hydraulic motor 4. Such a tool may be arranged to be inserted into the upper end of the tubular, with gripping elements of the tool being radially displaceable for engagement with the inner wall of the tubular so as to secure the tubular to the tool.

In use, a tubular (not shown) to be connected to a tubular string held in a spider (not shown) is located over the tool 30. The tool 30 grips the tubular. The apparatus 1 and the tubular are lowered by moving the top drive so that the tubular is in close proximity with the tubular string held in the spider. However, due to amongst other things manufacturing tolerances in the tubulars, the tubular often does not align

perfectly with the tubular held in the spider. The suspension unit 3 allows minor vertical and horizontal movements to be made by using alignment pistons 31 and 32 for horizontal movements, and piston and cylinders 23 and 24 for vertical movements. The alignment piston 31 acts between the rigid body 15 and the plate 7. The alignment
5 piston 32 acts between the slider 16 and the arm 19. The alignment pistons 31 and 32 and pistons and cylinders 23, 25 are actuated by hydraulic or pneumatic means and controlled from a remote control device.

The piston and cylinders 23, 24 are hydraulically operable. It is envisaged however, that the piston and cylinders 23, 24 may be of the pneumatic compensating
10 type, i.e. their internal pressure may be adjusted to compensate for the weight of the tubular so that movement of the tubular may be conducted with minimal force. This can conveniently be achieved by introducing pneumatic fluid into the piston and cylinder 23, 24 and adjusting the pressure therein.

Once the tubulars are aligned, the hydraulic motor 4 and 4' rotate the tubular via
15 gearing in the stator 5 thereby making up the severed connection. During connection the compensating piston and cylinders 23, 24 expand to accommodate the movement of the upper tubular. The alignment pistons 31 and 32 can then be used to move the top of the tubular into alignment with the top drive. If necessary, final torquing can be conducted by the top drive at this stage, via rotation of the pipe 27, and the main
20 elevator can also be swung onto and connected to the tubular prior to releasing the slips in the spider and lowering the casing string. It will be appreciated that the suspension unit 3 effectively provides an adapter for connecting a top drive to the tubular engaging tool 30.

CLAIMS

1. Apparatus for facilitating the connection of tubulars using a top drive, the apparatus comprising a motor (4, 4') for rotating a tool (30) for drivingly engaging a tubular, and means (3) for connecting said motor (4, 4') to said top drive, the apparatus being such that, in use, said motor (4, 4') can rotate one tubular with respect to another to connect said tubulars.
2. An apparatus as claimed in Claim 1, wherein said motor is hydraulically operable.
3. An apparatus as claimed in Claim 1 or 2, wherein said means comprises a suspension unit (3) which, in use, can move said motor relative to the axis of said top drive to facilitate aligning said tubulars.
4. An apparatus as claimed in Claim 3, wherein said suspension unit (3) is provided with at least one piston and cylinder (23, 24) in order to raise and lower said motor (4, 4').
5. An apparatus as claimed in Claim 4, wherein said at least one piston and cylinder can be pneumatically actuated to compensate for the weight of said tubular.
6. An apparatus as claimed in Claim 3, 4 or 5, wherein said suspension unit (3) comprises spherical bearings (20, 21) to allow movement of said motor in two planes.

7. An apparatus as claimed in any of claims 3 to 6, wherein said suspension unit (3) comprises adjustable pistons and cylinders (31, 32) to position said motor (4, 4').

5 8. An apparatus as claimed in any preceding claim, comprising a mud pipe (27) for delivering mud to said tubular.

9. An apparatus as claimed in Claim 8, wherein said mud pipe (27) is provided with a ball joint (28, 29) at both ends thereof.

10

10. An apparatus as claimed in any preceding claim, when supported by a top drive.

11. A method of connecting first and second tubulars for use in lining a borehole, the method comprising:

15 coupling said first tubular to a top drive using a suspension unit, wherein the tubular engages the rotor of a motor supported by the suspension unit;

engaging a lower end of said first tubular with an upper end of said second tubular;

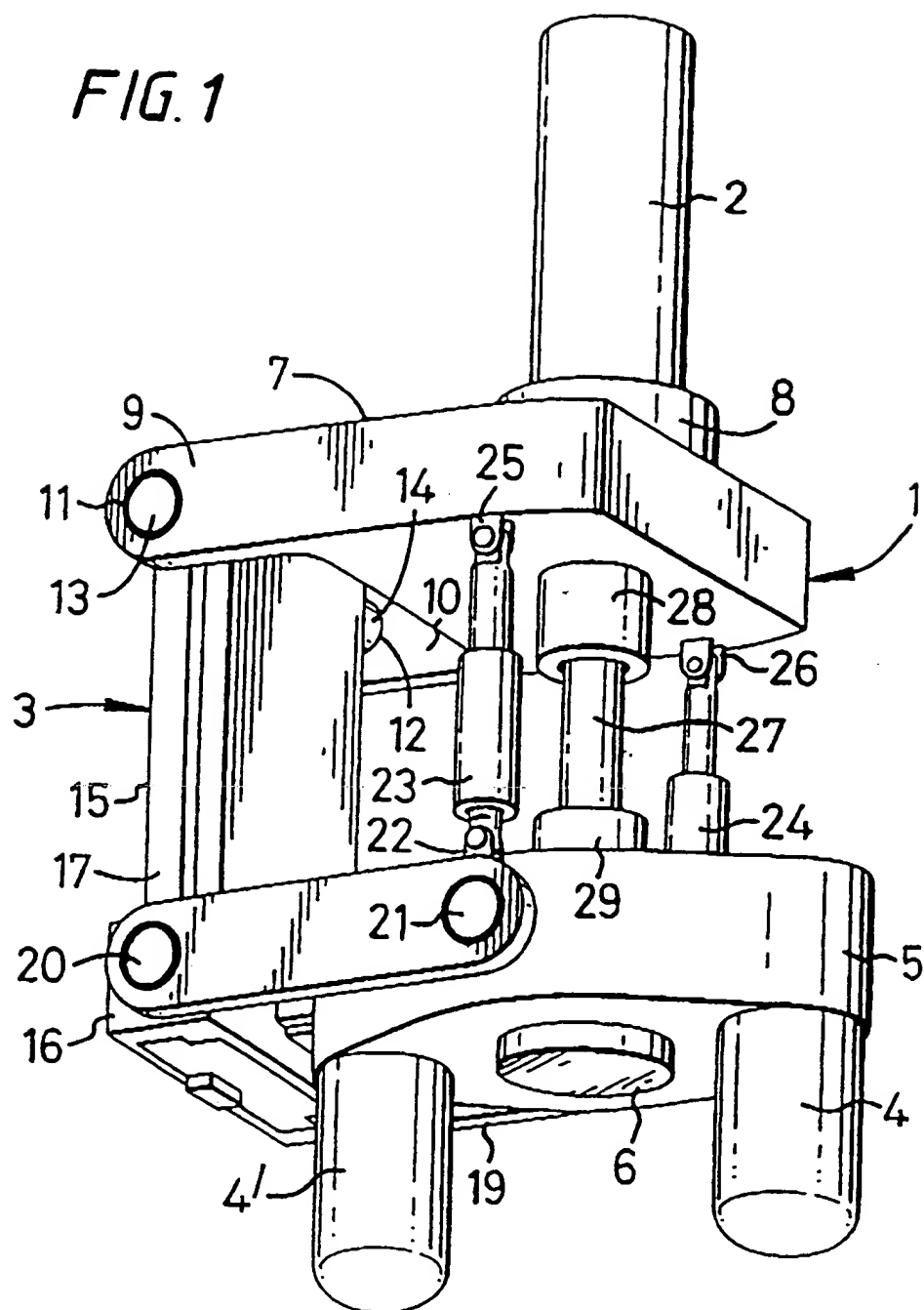
rotating said first tubular using the motor so as to screw the tubulars together;

20 and

tightening the connection between the tubulars by rotating the first tubular using the top drive.

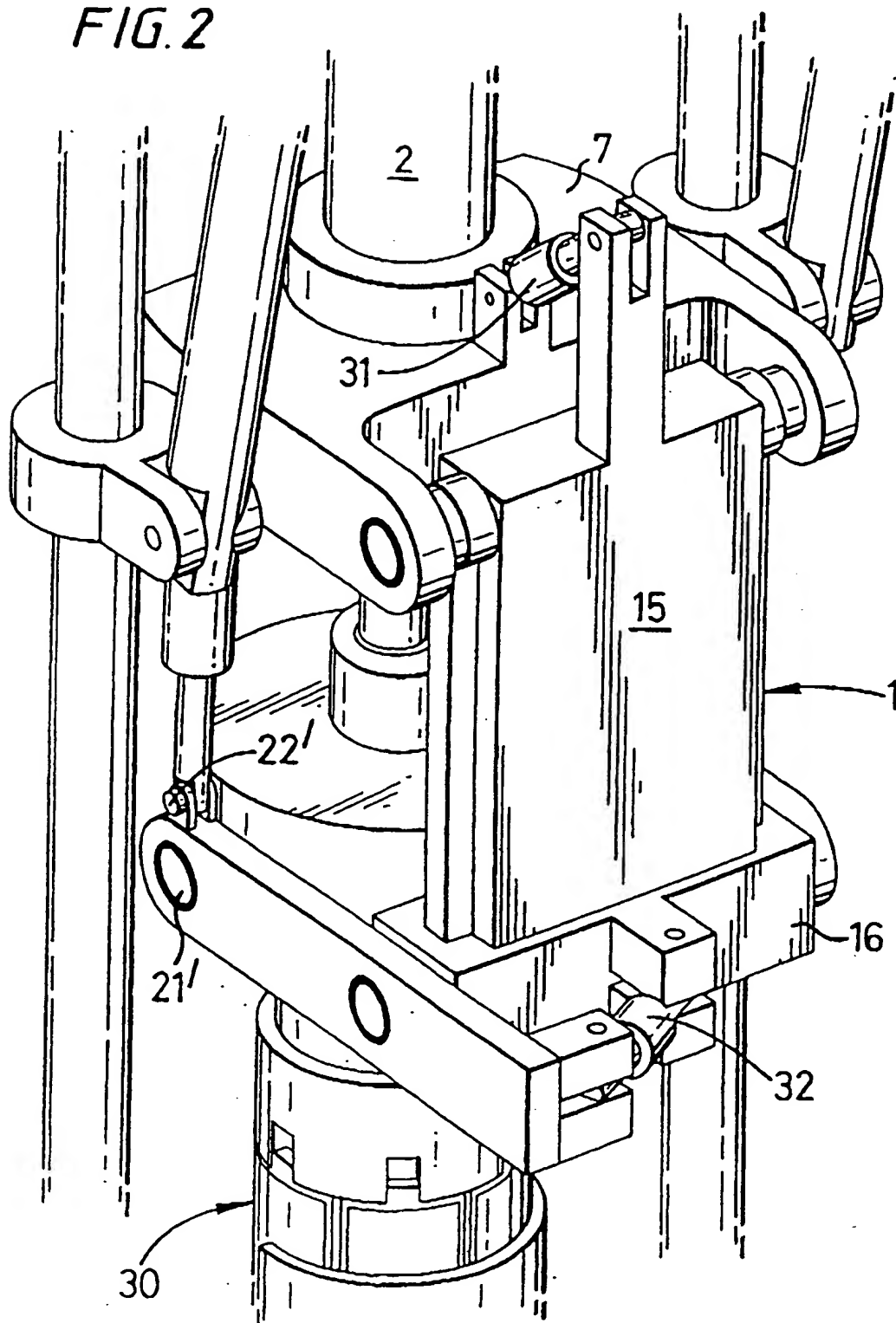
12. A method according to claim 11, the method comprising adjusting the suspension unit prior to tightening the connection using the top drive so as to bring the first tubular into alignment with the top drive.

FIG. 1



2/2

FIG. 2



INTERNATIONAL SEARCH REPORT

International Application No

17/GB 99/02708

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 E21B19/16

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 625 796 A (BOYADJIEFF GEORGE I) 2 December 1986 (1986-12-02) column 3, line 19-52 column 6, line 1-21 figures 1,2	1,2,8
X	US 4 449 596 A (BOYADJIEFF GEORGE I) 22 May 1984 (1984-05-22) column 11, line 33-59	1,8
X	US 3 766 991 A (BROWN C) 23 October 1973 (1973-10-23) abstract column 5, line 13-42 figure 1B	1
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

19 November 1999

Date of mailing of the international search report

26/11/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Schouten, A

INTERNATIONAL SEARCH REPORT

International Application No

/GB 99/02708

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4 813 493 A (SHAW DANIAL G ET AL) 21 March 1989 (1989-03-21) abstract; figure 1 ---	1,11
A	US 5 388 651 A (BERRY JOE R) 14 February 1995 (1995-02-14) column 7-8 figures 1,2 -----	1,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

I :/GB 99/02708

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4625796 A	02-12-1986	CA 1250569 A	28-02-1989
		EP 0202184 A	20-11-1986
		JP 1752104 C	08-04-1993
		JP 4034672 B	08-06-1992
		JP 61233194 A	17-10-1986
		NO 177018 B	27-03-1995
US 4449596 A	22-05-1984	CA 1194855 A	08-10-1985
		DE 3327739 A	16-02-1984
		DE 3347970 C	06-11-1986
		DE 3347971 C	30-10-1986
		DE 3347972 C	30-10-1986
		FR 2531479 A	10-02-1984
		FR 2565287 A	06-12-1985
		FR 2565288 A	06-12-1985
		FR 2565289 A	06-12-1985
		GB 2124680 A,B	22-02-1984
		GB 2152106 A,B	31-07-1985
		GB 2152107 A,B	31-07-1985
		GB 2152108 A,B	31-07-1985
		JP 1436263 C	25-04-1988
		JP 59044487 A	12-03-1984
		JP 62045392 B	26-09-1987
		NO 832774 A	06-02-1984
		NO 854202 A	06-02-1984
		NO 854343 A	06-02-1984
		NO 854358 A	06-02-1984
US 3766991 A	23-10-1973	NONE	
US 4813493 A	21-03-1989	WO 8808069 A	20-10-1988
		NO 885529 A	13-12-1988
US 5388651 A	14-02-1995	NONE	